

Response to reviews of

“Opinion: How Fear of Nuclear Winter has Helped Save the World, So Far” (modified title)
by Robock et al.

Responses are in blue.

Reviewer 1 (Alexander Kmentt)

This is a very important overview of the history of the nuclear winter research and the political significance of it. In the current situation of heightened nuclear risks (the Doomsday Clock stands at an unprecedented 90 seconds before midnight), this is a crucial contribution. It is particularly important to highlight that there is a lot of very "new" research that goes beyond the knowledge of nuclear winter of the 1980s. This "new" research thus merits a reassessment of the arguments around the sustainability of an approach to international security that is based on the preminent threat of inflicting mass destruction with the risk of causing nuclear winter. This knowledge needs to be further promulgated and form the basis of policy decisions regarding nuclear weapons.

Thanks for these encouraging words.

Below are some specific comments and recommendations on the text linked to specific lines in the manuscript:

Line Comment

1 Fear of nuclear winter is not the only reason why the « world has been saved » so far and nuclear war has not happened in the past 8 decades. It is a major contribution but many other factors have played a role. Suggest: How Fear of Nuclear Winter has Helped Save the World, So Far.

Accepted.

46 Suggest: ,for which the International Campaign to Abolish Nuclear Weapons (ICAN) received the 2017 Nobel Peace Prize

Accepted.

47 See comment re title: Nuclear winter is but one reason.

Accepted.

49 Possible technical errors go beyond computer and sensor malfunctions

Changed to “technical malfunctions, such as in computers and sensors,”

51 In addition to Russia's threats it is maybe worth highlighting that nuclear deterrence doctrines (of all nuclear-armed states) are based on the capability and readiness to use nuclear weapons

Accepted.

55 pp This whole section is really important as a background and history of the nuclear winter research.

Thanks.

It may be useful to explain a bit more in detail (lines 117 pp) how exactly progress in computing and climate modelling contributed to "new" knowledge. This is against the background that some nuclear-armed states claim that there is nothing "new" and that they knew about the humanitarian consequences and nuclear winter all along. A bit more detail here could be helpful in clarifying that the situation regarding nuclear winter research is fundamentally different and "new" compared to the 1980s.

In the new lines 120-125 we added, "In the 1980s the fastest "supercomputers" were orders of magnitude slower and had orders of magnitude less storage than the smartphones most of us carry around in our pockets today. Thus, simulations had to ignore much of the physics and chemistry of the atmosphere and they could not represent the full depth of the atmosphere or be run long enough to study the interannual response to smoke injection." And in the new lines 135-138 we added, "For the first time, we learned that smoke would stay in the stratosphere for multiple years because we could simulate the heating and lofting of the smoke, preventing it from quickly falling out of the air."

210 Factual correction: ICAN did not organise the 3 international conferences. These were organised by Norway, Mexico and Austria as governmental expert conferences. ICAN and other NGOs as well as academic experts were invited to participate. ICAN organised separate civil society events in the margins of the three governmental conferences. Furthermore, ICAN campaigned for states to attend. Other than that, ICAN did not have any responsibility in the organisation of the governmental conferences.

Thanks for the correction. The paper has been modified to correct these facts.

220 Factual correction: The process to obtain a negotiation mandate in the UN General Assembly was led by four countries Austria, Ireland, Mexico and South Africa – and this group was later expanded to include Brazil, Costa Rica, Indonesia, New Zealand, Nigeria and Thailand. These states submitted resolutions in the General Assembly which garnered the necessary support from States. ICAN successfully campaigned all along for states to support this process but it is important to be clear that this was a state-led process.

Thanks for the correction. The paper has been modified to correct these facts.

224 Important not to omit the crucial role of the International Committee of the Red Cross (ICRC)

Added.

242 pp I would suggest not to make too much of the attendance as observers. As welcome as it is, these states have stated their intention not to join the treaty. The transformational strength of the TPNW does not come from this. It is the normative pressure through increasing ratifications and signatories and the political pressure that comes from the TPNW underlying arguments on the humanitarian consequences and risks of nuclear weapons. This is a discursive process that has both a legal and a political dimension.

That part has been removed, and the paragraph changed to, “Unfortunately, the nine nuclear states have not yet ratified the treaty and have encouraged their allies to ignore it. But gradually, the will of the rest of the world demanding the abolition of nuclear weapons is being felt through pressure from increasing ratifications and signatories and the political pressure that comes from the TPNW’s underlying arguments on the humanitarian consequences and risks of nuclear weapons.”

304 It is not just the increasing instability in South Asia. I would suggest “In view of today’s high level of nuclear risks”

Done.

329 pp It might be worthwhile to reference the fact that the impact of such famine scenarios on social structures, likely societal collapse, infrastructure, mass migratory movements, psychological impact etc. are not considered in these studies but that would have to be included in any comprehensive attempt to understand the full scale impact of such scenarios.

Some of those are already in the paper, but we added infrastructure and psychological impact to those factors still needing study.

368 Factual correction: The presentation was actually made at the 2022 Vienna Conference on the Humanitarian Impact of Nuclear Weapons (www.HINW22vienna.at), which was organised by Austria on the day before the First Meeting of States Parties

Corrected.

388 While the G20 statement is very important, its link to nuclear winter argument is not really clear. The reference to “inadmissible” is more a reference to the legal/prohibitive aspect of nuclear weapons use.

394 See above: nuclear deterrence depends on the readiness and capability to use nuclear weapons.

But the statement does contradict their claim to only keep nuclear weapons for deterrence, so we will leave it as is. It may not refer directly to nuclear winter, but then again, threatening the use of nuclear weapons does involve impacts on those who use them.

Reviewer 2

This opinion piece addresses a very important topic, which has, unfortunately, become very timely again in the current political situation. The paper provides a comprehensive overview on the history of research performed on the climatic effects of a nuclear war, and how this research affected global politics. While the basic scientific findings regarding the climatic consequences of a nuclear conflict have been robust over the years, more recent studies go beyond the climate response and highlight the dramatic humanitarian impacts of a nuclear winter. I agree with the authors that the disastrous threat from nuclear weapons to human mankind can never be stressed enough.

Thanks very much.

Below a few more specific comments.

I find the title a bit confusing and misleading. In my view, the term “nuclear winter” describes not only the theory behind, but the occurrence. Luckily, the world has not yet experienced nuclear winter so far, so how could nuclear winter have saved the world . The title of the paper became only clear to me after I had read the abstract.

In response to Reviewer 1, we have changed the title to “Opinion: How Fear of Nuclear Winter has Helped Save the World, So Far”

The paper focuses mainly on nuclear winter and its consequences on world agriculture as indirect effects of a nuclear war that would also affect other regions than those directly involved in the war. This is in a way understandable as it is the research topic of the authors, but how about effects on regions further away from the combat zone from the long-range transport and fallout of radioactive material?

We have not analyzed the impacts of radioactivity with our modern models yet, but are in the process of doing that study. However, radioactivity impacts would be confined to regions near targets of nuclear weapons, and we here focus on the much greater impacts on food. We have added a sentence to that effect in new line number 359-361, “Also, we have not analyzed the impacts of radioactivity yet, but radioactivity impacts would be confined to regions near targets of nuclear weapons, and we here focus on the much greater impacts on food.”

L61: Do you mean “The smoke cloud would spread ...”. Otherwise, either “could” or “would”, but not both.

Deleted “could.” Thanks for catching that.

L80-82: I find this sentence a bit weird. I assume the authors want to highlight the gap in published articles on the nuclear winter topic between the 1990s and the 2000s, but I do not get the point about the launch of ACP.

This paper is part of a special 20th anniversary special issue of *ACP*, and so we make reference to that.

L114: "... and they outlined..." ?

Yes. That was a typo. We changed "the" to "they"

L129: "The basic conclusion..."

Corrected.

L151-153: I am not sure that the sentence makes sense as is. Maybe: "Observations of firestorms, that pumped smoke into the stratosphere after the August 6, 1945 atomic bombing of Hiroshima and the April 18, 1906 San Francisco earthquake, are evidence..."

Thanks for catching that, too. Changed to "Observations of firestorms, which pumped smoke into the stratosphere after the August 6, 1945 atomic bombing of Hiroshima and the April 18, 1906 San Francisco earthquake, are evidence..."